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The U.S. military is transitioning away from traditional ground wars and moving toward high-tech future wars in emerging domains. Future conflict will be more complex and the focus on technology by all branches of the military means an ever-increasing need for qualified and talented recruits who possess the basic skills required to be successful in today's military, and the aptitude and increased capability to maneuver within these emerging technologies of the future. This research analyzes the Armed Services Vocational Aptitude Battery (ASVAB), an aptitude test used by all branches of the armed services and identifies what the changes in scores for Army enlisted applicants from 2003 to 2015 could mean for future Army force readiness.

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by

Mark C. Hoover

United States Department of State

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THE UPS AND DOWNS OF ASVAB: FLUCTUATION IN ARMED SERVICES VOCATIONAL APTITUDE BATTERY SCORES AND IMPLICATIONS FOR U.S. ARMY FORCE READINESS

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Mark C. Hoover

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A paper submitted to the Faculty of the Joint Advanced Warfighting School in partial satisfaction of the requirements of a Master of Science Degree in Joint Campaign Planning and Strategy. The contents of this thesis reflect my own personal views and are not necessarily endorsed by the National Defense University, Joint Forces Staff College, the Department of State, or the Department of Defense.

This thesis is entirely my own work except as documented in footnotes, or appropriate statement per the Academic Integrity Policy.

March 30, 2017

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Abstract

The U.S. military is transitioning away from traditional ground wars and moving toward high-tech future wars in emerging domains. Future conflict will be more complex and the focus on technology by all branches of the military means an ever-increasing need for qualified and talented recruits who possess the basic skills required to be successful in today's military, and the aptitude and increased capability to maneuver within these emerging technologies of the future. This research analyzes the Armed Services Vocational Aptitude Battery (ASVAB), an aptitude test used by all branches of the armed services and identifies what the changes in scores for Army enlisted applicants from 2003 to 2015, could mean for future Army force readiness.

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Dedication

This thesis is dedicated to my late grandmother Virginia Ann Geil.

Her *"We can do it!"* spirit during World War II and her work on the B-29 Bomber will never be forgotten.

I also dedicate this thesis to my late grandfather, John Henry Geil.

His service during the Cold War and pioneering role in the development of early national defense systems is forever remembered here.

Finally, I dedicate this thesis to my wife and daughters.

Your patience and understanding during the hundreds of hours of research and writing required for this study have not gone unnoticed.

Thank you girls!

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Chapter 1: Introduction

Of the 21 million Americans aged 17-to-21, we estimate that only about half are able to meet our high-quality standards on our entry exam – only about half. And when you factor in our standards for physical fitness and for character, only about a third are actually eligible to join the military. And as people already in our military retire or move on to new opportunities in life, we have to bring in about 250,000 each year just to keep up.
-Secretary of Defense Ash Carter. Force of the Future- March 2015.[1]

Future conflict for the United States will continue to grow in complexity and require the use of advanced technology, and service members across all branches of the military must be increasingly capable to meet these growing demands. This study will discuss the Armed Services Vocational Aptitude Battery (ASVAB), a tool used as a measurement of aptitude for entry to military service across all branches of the armed forces. Because a study across all branches of the armed forces would be too exhaustive, complex, and far beyond the scope of this paper, the author focuses upon the ASVAB results of the Army as an indicator for all branches of the armed services. Future study of the other military services is recommended.

According to former Secretary of Defense Ash Carter, only about half of the eligible candidates for military service are able to meet the rigorous standards of the military entrance exam, the ASVAB. Couple that with their inability to meet character and physical fitness standards, and it is clear that only about one-third are eligible for enlistment in the armed forces. This presents a serious consideration for a joint force that requires nearly 250,000 new recruits each year just to maintain current staffing levels.[2] General Robert B. Abrams, Commanding General of U.S. Army Forces Command

[1] Secretary of Defense Ash Carter, *Force of the Future Speech*. March 30, 2015. https://www.defense.gov/News/Speeches/Speech-View/Article/606658/remarks-by-secretary-carter-on-the-force-of-the-future
[2] Carter. 2015.

declared it imperative for the Army to be combat ready, and globally responsive, with soldiers that are well led, disciplined, trained, and expeditionary to win in a complex world.[3] Although this complex world seems to grow more dependent upon technology with each passing day, the Army is also reliant upon a human workforce that must be properly recruited, trained, and equipped to ensure a ready force capable of sustaining the battles of the future.

As the United States military transitions away from traditional ground wars and positions for high-tech wars in emerging domains, the U.S. Army is called upon to maintain its force readiness. As robotic systems become increasingly autonomous and move toward the performance of highly complicated processes without human operators, even to the point of being able to exercise lethal force without human consent, the Army must keep pace.[4] Keeping pace means recruiting, training, and equipping a force to meet the current demand for personnel, and also the demands well into the future. The domain shift toward future technology presents potential challenges for the Army and its recruitment of the Force of the Future. It requires the Army to not only recruit enlisted personnel who possess the basic skills and aptitude required for a successful career across the normal range of traditional military occupations, but also a fighting force with aptitude in areas of emerging technology to meet the challenges of the future.

The Army's modernization strategy focuses on funding five key program areas: protecting science and technology investments to prepare for the future; investing in a limited number of new developmental programs to address only the most critical capability gaps; incrementally modernizing a small number of its current systems to

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[3] General Robert B. Abrams. Army Forces Command, *Statement on Readiness*. September 8, 2016.
[4] Seth Thornhill. JAWS Thesis, *Future Autonomous Robotic Systems in the Pacific Theatre*. 2015.

extend service life and upgrade their capability to maintain overmatch; sustaining and resetting current equipment to meet near-term readiness requirements; and divesting obsolete and nonstandard equipment to free up resources for reinvestment in higher priorities.[5] Each of these priorities involves a reliance upon and understanding of technology, and requires a force that is increasingly capable and has the appropriate aptitude to succeed.

One manner in which the Army ensures the appropriate aptitude of its enlisted personnel is through the administration of the Armed Services Vocational Aptitude Battery (ASVAB), an assessment which measures not only aptitude, but also serves as a reliable indicator of success across the span of a normal military career.[6] This thesis begins with an examination of the ASVAB scores for all Army enlisted applicants who took the ASVAB in 2003 and 2015. It first looks at the mean scores for each year in four specific areas; General Science, Arithmetic Reasoning, Word Knowledge, and Mechanical Comprehension. The paper then looks at the positive and negative gains observed in mean score from 2003 and 2015, and determines whether the changes are statistically significant. It then explains how the Army uses the scores in each area to determine admissibility for Army enlisted service and for the assignment of a career specialty. The paper concludes with the identification of possible implications these negative or positive gains may have for force readiness of the Army of the future, and provides recommendations for future research and study.

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[5] Murray, John M. 2016. "Modernization Vital to Joint Force Success." Army Magazine 66, no. 10: 155-158.

[6] W.S. Sellman. NAGB, *Predicting Readiness for Military Service: How Enlistment Standards are Established.* September 2004.

Chapter 2 is a review of related literature as researched by the author in the development of this thesis. It first presents literature relative to the design and scientific validity of the ASVAB as an assessment tool and further points to the ASVAB as being a valid predictor of readiness for military service of enlisted personnel. The chapter then explores relevant literature relating to the Army's use of the ASVAB as a screening tool to determine basic Army admissibility as well as its use of the assessment to assign a particular career specialty. The chapter then reviews literature relating to the most recent U.S. government senior policy guidance, and it explores the implications of that guidance upon the future military force. The chapter concludes with a review of literature relating to future force requirements and military technological advances.

Chapter 3 provides the methodology used during this study. The first portion of the chapter introduces the focus of the study and its qualitative nature as well as the research approach used. The research question, and research limitations are then discussed followed by the target population and sampling. The chapter concludes with a discussion of the independent variables, external validity, and the statistical methods used in the analysis.

Chapter 4 starts with a thorough discussion of the data studied in this case. It explains any changes in ASVAB scores that occurred from 2003 to 2015. The chapter then discusses the statistical significance of any changes in ASVAB scores and breaks down the data by testing area: General Science, Arithmetic Reasoning, Word Knowledge, and Mechanical Comprehension. The chapter concludes with a summary of the findings, the author's conclusions of what the implications are for future force readiness, and concludes with recommendations for future research.

Purpose and Scope of the Project

The purpose of this project is to identify changes in the Armed Services Vocational Aptitude Battery (ASVAB) scores of Army enlisted applicants in the years 2003, 2009, and 2015 to identify what implications these positive or negative gains may mean for U.S. Army force readiness in the future. The scope of this project is all Army enlisted applicants who took the ASVAB in 2003, 2009, and 2015. The data studied was the ASVAB raw scores provided by the Defense Manpower Data Center. The study does not consider scores other than for the years listed. The study focuses on descriptive statistics and does not undertake inferential analysis.

Significance of the Project

This project is significant and important because it will determine what changes, if any, have taken place in ASVAB scores between 2003, 2009, and 2015, and will identify implications for Army force readiness. As the Army adapts to a changing environment it must ensure that it continues to recruit and employ a capable and ready force of soldiers who meet the needs of the future. Building upon prior research in the area of the ASVAB as a predictor of readiness, this study will further highlight the implications changes in ASVAB scores in 2003 and 2015 may have on force readiness. This study provides a previously unavailable perspective on Army force readiness because it quantifies concerns about force readiness, not only in the basic career fields, but also in emerging highly technical positions and requirements.

Limitations of the Project

Because the number of enlisted applicants who took the ASVAB between 2003 and 2015 is very large, this project is limited to only those Army enlisted applicants who took the ASVAB in 2003, 2009, and 2015 to allow a measurable number for this study. This research maintains a focus only on the subtests for General Science, Arithmetic Reasoning, Word Knowledge, and Mechanical Comprehension because these subtest scores are utilized in the calculation of a broad array of Subject Area test scores.

Definition of Terms

Armed Services Vocational Aptitude Battery (ASVAB): The Armed Services Vocational Aptitude Battery is the most widely used multiple-aptitude test battery in the world.[7] As an aptitude test, the ASVAB measures test taker strengths, weaknesses, and potential for future success. The ASVAB also provides the test taker with career aptitude measurement information for various civilian and military occupations and is an indicator for success in future endeavors in college, vocational school, or a military career. The ASVAB is used by all branches of the U.S. armed services to determine admissibility for military service and assignment to a career specialty within the services.

Third Offset Strategy: A Department of Defense innovation initiative first announced by Secretary of Defense Chuck Hagel in November, 2014 and built upon by Secretary of Defense Ashton Carter which deals with anti-access and area-denial, guided munitions, undersea warfare, cyber and electronic warfare, human-machine teaming, and war-

[7] http://www.military.com/join-armed-forces/asvab/asvab-test-explained.html

gaming and development of new operating concepts. This strategy is based upon the first and second offset strategies and has as its core goal the maintaining of U.S. military superiority over adversaries through the development of advanced capabilities.[8]

Force of the Future: A series of initiatives announced by Secretary of Defense Ashton Carter in November 2015 which were designed to maintain the U.S. Department of Defense's competitive edge in the recruitment of personnel with high levels of talent and capability. Portions of the initiative are targeted at gaining personnel with highly technical expertise.

Joint Force 2020: Signed by General Martin Dempsey, Chairman of the Joint Chiefs of Staff in September 2012, the Capstone Concept for Joint Operations; Joint Force 2020 served as a new concept of operations to address the transition by the U.S. military away from more than a decade of wars toward addressing security paradoxes in which destructive technologies are available to a wide and disparate group of adversaries. By globally integrating operations, the military will be capable of integrating capabilities across domains, echelons, geographic boundaries, and organizational affiliations.[9]

Defense Strategic Guidance: Published in January 2012 and signed by President Barack Obama and Secretary of Defense Leon Panetta, this document is the senior level guidance toward sustaining U.S. global leadership in the 21st century with a smaller, leaner force.

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[8] https://www.defense.gov/News/Article/Article/991434/deputy-secretary-third-offset-strategy-bolsters-americas-military-deterrence

[9] http://www.dtic.mil/doctrine/concepts/ccjo_jointforce2020.pdf

It outlines a new force that is more agile, flexible, ready, and technologically advanced with cutting edge capabilities; exploiting technological, joint and networked advantages.[10]

Army Force Readiness: The capability of the Army to perform the missions or functions for which it was organized or designed. This readiness is based upon the Army's four pillars; manning, training, equipping, and developing leaders. Army readiness is measured by the Army's ability as a whole to defeat, deny, or deter hybrid, near-peer threats and meet operational demands.[11]

Traditional Warfare: Traditional military operations conducted by using conventional weapons and battlefield tactics between two or more states in open confrontation. The forces on each side are well-defined, and fight using troops and weapons that primarily target the opponent's military.[12]

Military Occupational Specialty: A career field within the military to which an enlisted member is assigned.[13]

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[10] Defense Strategic Guidance http://www.acq.osd.mil/ecp/DOCS/ECP_Mission_Overview_May2015.pdf
[11] U.S. Army Readiness Guidance. 2016-2017. https://www.army.mil/standto/2016-05-19
[12] Observations of a Strategic Corporal.
http://www.au.af.mil/au/awc/awcgate/milreview/mitchell_observs_of_strat_corp.pdf
[13] U.S. Army http://army.com/info/mos/all

Army Total Force: A program designed to integrate the active duty and reserve components of the Army into a more aligned force based upon the particular attributes of the particular component and individual competencies.[14]

Validity: The degree to which evidence and theory support the interpretation of test scores entailed by a proposed use of tests. Validity is the most fundamental consideration in developing and evaluating tests. [15]

[14] Real Clear Defense.
http://www.realcleardefense.com/articles/2016/06/30/army_total_force_policy_109504.html
[15] American Educational Research Association, American Psychological Association, National Council on Measurement in Education. The Standards for Educational and Psychological Testing. 1999.

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Chapter 2: Review of Related Literature

Introduction

A review of relevant literature was conducted to support the area of study undertaken in this thesis. A general survey of past research in the area of Army force readiness and the ASVAB was conducted to determine what research and published guidance already exist in this area. Secondly, research was conducted into the ASVAB and its design, purpose, validity, and role as a reliable predictor of readiness for enlistment into military service. Lastly, research into future requirements and the projected future force readiness needs of the Army was conducted. The researcher identified the following literature to be relevant to the area of study.

ASVAB Explained

In 1974, all military branches began using the ASVAB for selection and classification of enlisted personnel as the standard by which enlisted applicants are measured and decisions regarding admissibility for military service are made. [16] The ASVAB is a series of tests that was designed by the Department of Defense to measure a test-takers aptitude for military service. All branches of the military services also use the ASVAB to help determine the particular Military Occupational Specialty (MOS) career field to which an enlisted member is assigned. The ASVAB is administered electronically at Military Enlistment Processing Stations (MEPS) and in paper form at Military Entrance Test (MET) sites. It is also administered to students at high schools around the country

[16] U.S. Department of Defense. Official ASVAB Information. *History of the ASVAB*. http://official-asvab.com/history_res.htm

through the Career Exploration Program (CEP) which helps students determine whether they are college and career ready.[17]

Design and Scientific Validity of ASVAB

The Armed Services Vocational Aptitude Battery is an assessment tool used to determine the enlistment eligibility and occupational assignment of Army, Navy, Marine Corps, and Air Force applicants.[18] ASVAB is scientifically developed and validated to ensure that those enlisted into the armed services have a reasonable probability of completing basic military training and technical training, and successfully performing the duties of their career field once assigned.[19] In 2003, the ASVAB was administered to more than 400,000 applicants for military service at locations across the United States to determine their aptitude for military service.

A 2004 report by W.S. Sellman entitled Predicting Readiness for Military Service was prepared for the National Assessment Governing Board. This report serves as an excellent reference for how assessments standards are established. It also references the reliability of the ASVAB testing system as a tool for determining the aptitude for military service for potential enlisted personnel. The ASVAB is described by Sellman below;

> The Department of Defense uses a single battery, the Armed Services Vocational Aptitude Battery (ASVAB) to determine the enlistment eligibility of applicants for the Army, Navy, Marine Corps, and Air Force, as well as their respective Reserve Components. The ASVAB also is used to assign successful applicants to military occupations. The value of ASVAB is well proven. It was scientifically developed and validated to ensure that all enlistees would have a reasonable probability of completing military job skill training and performing successfully on the job.[20]

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[17] United States Department of Defense. *The Army Guide to ASVAB*. www.Goarmy.com
[18] U.S. Department of Defense. ASVAB official site. http://official-asvab.com/index.htm
[19] Sellman, 2004.
[20] Ibid.

> The ASVAB is a battery composed of various tests that measure verbal, mathematics, and science/technical skills and knowledge. The Armed Forces Qualification Test (AFQT), a composite of verbal and mathematics tests from ASVAB, is the primary enlistment screen. The battery is normed against a nationally representative sample of young people ages 18 - 23 that tested in 1997. This allows the comparison of applicant and recruit aptitude levels with those of the contemporary civilian youth population from which they come. [21]

ASVAB Subtests

The ASVAB is comprised of eight subtests which consist of series of 200 questions. and cover the following areas;

General Science (GS): A 25-item test measuring knowledge of life science, earth and space science, and physical science

Arithmetic Reasoning (AR): A 30-item test measuring ability to solve basic arithmetic word problems

Word Knowledge (WK): A 35-item test measuring ability to understand the meaning of words through synonyms

Paragraph Comprehension (PC): A 15-item test measuring ability to obtain information from written material

Mathematics Knowledge (MK): A 25-item test measuring knowledge of mathematical concepts and applications

Electronics Information (EI): A 20-item test measuring knowledge of electrical current, circuits, devices, and electronic systems

[21] Ibid.

Auto and Shop Information (AS): An 11-item test measuring knowledge of wood and metal shop practices

Mechanical Comprehension (MC): A 16-item test measuring knowledge of the principles of mechanical devices, structural support, and properties of materials

ASVAB Subject Area Scores

ASVAB has ten Subject Area (SA) scores which are calculated by the combination of a series of Subtest scores. These Subject Area (SA) scores are aligned to meet the recruitment needs of the various branches of the military.[22] The Subject Areas are listed below, followed by the particular combination of Subtest scores used in their calculation.

Clerical (CL): Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning and Mathematics Knowledge.

Combat (CO): Word Knowledge, Paragraph Comprehension, Auto & Shop and Mechanical Comprehension.

Electronics (EL): General Science, Arithmetic Reasoning, Mathematics Knowledge and Electronic Information.

Field Artillery (FA): Arithmetic Reasoning, Mathematics Knowledge and Mechanical Comprehension.

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[22] U.S. Army Official ASVAB Guide. *Understanding the ASVAB.* http://www.goarmy.com/learn/understanding-the-asvab.html

General Maintenance (GM): General Science, Auto & Shop, Mathematics Knowledge and Electronics Information.

General Technical (GT): Word Knowledge, Paragraph Comprehension, and Arithmetic Reasoning (AR).

Mechanical Maintenance (MM): Auto & Shop, Mechanical Comprehension and Electronic Information.

Operators and Food (OF): Word Knowledge, Paragraph Comprehension, Auto & Shop and Mechanical Comprehension.

Surveillance and Communications (SC): Word Knowledge, Paragraph Comprehension, Arithmetic Reasoning, Auto & Shop and Mechanical Comprehension.

Skilled Technical (ST): Word Knowledge, Paragraph Comprehension, General Science, Mechanical Comprehension and Mathematics Knowledge.

Army Force Readiness Guidance

Army Force Readiness is measured by its ability to defeat, deny, or deter hybrid, near-peer threats and meet operational demand requirements. According to the U.S. Army Force Readiness guidance issued for 2016-2017, the Army is working to improve overall readiness to a position which it refers to as a "Ready Army" by 2020.[23] This is important to the Army because readiness is its top priority and enables the Army to be ready to address a constantly changing world-wide security environment and maintain its

[23] Army Readiness Guidance. ability to defeat, deny, or deter hybrid, near-peer threats and meet operational demand requirements

ability to fight and win wars. Army readiness is grounded upon the four pillars of manning, training, equipping, and leader development, as described in the excerpt below from the most recent Army Force Readiness guidance.[24]

Manning: The Army will keep units predictably manned with a focus on maximizing personnel readiness and deployability by providing commanders with more precise personnel readiness standards and reporting tools, and by continuing to assess new qualified Soldiers to maintain total force end strength.

Training: The Army will continue to provide tough, realistic, combined arms and joint training to generate ready units with Decisive Action/Unified Land Operations (DA/ULO) proficiency.

Equipping: The Army will continue to equip, sustain, and modernize the force to ensure that units have the equipment required to maintain technological overmatch and defeat any threat.

Leader Development: The Army will continue to recruit and develop strong, moral, and ethical leaders to ensure readiness now and into the future.

The Army requires a well-trained and well equipped force to remain healthy and successful, able to address the challenges of the future. The ASVAB score, when

[24] U.S. Army. *Force Readiness Guidance.* 2016-2017. https://www.army.mil/standto/2016-05-19

considered with gender and rank has been shown to be a reliable predictor of success in Army specialties.[25]

Relaxing of Recruitment Standards

Maintaining a fully staffed and capable workforce is a key component of military readiness. A 2001 study by Lawrence Kapp for the Congressional Research Service pointed to strong recruiting efforts following incidents of national significance.[26] Kapp's research also points to a relaxing of military recruitment standards during periods of critical need. This standard adjustment has helped to meet key national security goals of staffing much needed enlisted military positions in the past. While a relaxing of standards may serve to meet national recruitment goals, it may also produce a recruit who has a lower aptitude in certain key areas.

Senior Policy Guidance and Implications

The joint military operational environment continues to grow in complexity and the need for technically competent enlisted military personnel is critical. This need for tech savvy soldiers exists across all branches of the military services including the Army which must be able to meet the needs of a highly technology dependent fighting force as outlined in Joint Vision 2020 and Force of the Future initiatives as informed by the 3rd offset strategy.

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[25] Grant, Joel, Angel L. Vargas, Robert A. Holcek, Carolyn H. Watson, Jessica A. Grant, and Forest S. Kim. Military Medicine 177. *"Is the ASVAB ST Composite Score a Reliable Predictor of First-Attempt Graduation for the U.S. Army Operating Room Specialist Course?"* 2012.

[26] L. Kapp. Congressional Research Service. Recruiting and Retention: *An Overview of FY2011 and FY2012 Results for Active and Reserve Component Enlisted Personnel.* May, 2013. https://www.fas.org/sgp/crs/natsec/RL32965.pdf

Third Offset Strategy

In his April 28, 2016 speech in Brussels, Deputy Secretary of Defense Bob Work discussed the Third Offset Strategy. In his discussion, he mentioned that there are two things that keep him up at night; the threat of terrorism and the challenges posed by a resurgent Russia.[27] Work said that he believes both of these issues will require a "new 21st Century approach," and strengthened deterrence in a way that the United States has not really thought about since the end of the Cold War. The threats posed by a resurgent Russia in Europe and a rising China in the Far East have signaled an era of new great power competition and serve as a reminder of the terrible dangers involved in a war between two great powers.

Work's view is that it is in the interest of the United States and NATO to maintain strong nuclear and conventional deterrence to ensure that a collision of two great powers is not allowed to happen again, Work describes this as having comprehensive stability through strategic parity; both the United States and Russia having enough nuclear bombs to devastate each other. Beyond the nuclear deterrence is the conventional deterrence. In order to preserve peace in an era where Russia and China are both making strides in the development of more advanced conventional capabilities, the United States must ensure an overmatching of capabilities to make the chances of war between great powers "infinitesimally small."[28]

With both Russia and China improving their capabilities at sea, on land, and in the air, and with the growth of their cyber, electronic, and space warfare platforms toward a first-

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[27] Deputy Secretary of Defense Bob Work. Speech in Brussels, Belgium. April 28, 2016. https://www.defense.gov/News/Speeches/Speech-View/Article/753482/remarks-by-d%20eputy-secretary-work-on-third-offset-strategy

[28] Deputy Secretary Work. Brussels Speech. April 28, 2016.

strike capability in the conventional (non-nuclear) domain, it is even more important to increase the margin of technological superiority according to Deputy Secretary Work.[29] He describes the Third Offset Strategy as combinations of technology, operational concepts, and organizational and force constructs to maintain the ability to project U.S. combat power into any area at the time and place of their choosing.

According to Work, this strategy will depend largely on the development and use of Artificial Intelligence (AI) and autonomous technologies in cyber defense, electronic warfare defense, missile defense, and the deployment of human-machine battle networks. Work further describes an environment where the U.S. and allies stand up new operational "fire source networks" with artillery, rockets and conventional ballistic missiles where any soldier in NATO could be able to call in the fires.[30] It is clear that the Third Offset strategy toward high-tech conventional deterrence and autonomous and artificial intelligence signifies a continuing need for a highly competent and technically qualified military work force.

Joint Vision 2020

In the year 2000, the Chairman of the Joint Chiefs of Staff published Joint Vision 2020. The Chairman summarized his goal as "Dedicated individuals and innovative organizations transforming the joint force for the 21st century to achieve full spectrum dominance." This vision builds upon and extends the conceptual template established by Joint Vision 2010 to guide the continuing transformation of the Armed Forces to fight and win America's wars.[31] Vision 2020 lays out its purpose and the factors necessary for

[29] Ibid.
[30] Ibid.
[31] U.S. Department of Defense. Joint Forces Quarterly. *Joint Vision 2020.* Summer 2000.

the joint force to be successful, including human talent, a professional well-trained, and ready force, and further details the military operational capabilities needed for a successful joint force through 2020 and beyond.

Among the operational concepts necessary to carry out this vision is the commitment to continued development of new military personnel and capabilities. In this way the United States can build the most capable and effective military force by 2020. This force will not only be joint as an organization through the use of joint doctrine, but also joint intellectually and technically. This level of jointness requires a highly capable military force. In his strategy, the Chairman points to two factors as having the potential to have strong influence over the achievement of these goals: the continued development and proliferation of information technology, and the armed forces continued reliance on capacity for intellectual and technical innovation.

Changes in the pace of technology will impact America's ability to nurture innovation in its personnel and across the branches of the military, which will impact joint operations. This strategy rests upon the fact that the information, information processing, and information networks are at the center of our activities as a military and indicate an increased reliance on technology for the accomplishment of our missions. Because of this increased technological imperative, it is then essential that U.S. troops be highly capable from a technological standpoint in order to meet the growing demands of an increasingly more technologically dependent joint military force.

Force of the Future

This shift is due in part to the Third Offset Strategy which seeks to address the shrinking U.S. military force structure and close the gap on a declining military

technological superiority. This signals not only a search for new technologies that give the U.S. a technological advantage, but also takes a fresh look at improving existing capabilities at low cost. This focus on technology means an ever-increasing need for qualified and talented recruits who not only possess the basic skills required to be successful in today's Army, but also a cadre of young people who possess the aptitude to maneuver within these emerging technologies and transform the U.S. military into what Secretary of Defense Ash Carter refers to as the "Force of the Future."

Secretary of Defense Ash Carter reinforced this commitment to increased technology within the joint force when he announced his "Force of the Future" initiative in 2015.[32] A major component of this initiative is an improved technological capability of the military and a commitment to the recruitment of personnel with the requisite capability to address increased technological demands. Technological capability depends heavily upon the military personnel and their skill and a commitment to increased technology in the military relies heavily upon a highly skilled military workforce, capable of keeping pace with rapidly emerging technology.

In order to field a strong military, the U.S. must ensure it continues to set appropriate standards for the recruitment and retention of military recruits. To maintain its position as the preeminent fighting force worldwide, able to address the evolving threats of violent extremism and terrorism, and the persistent risk of threats to America and its allies as outlined in the President's 2015 National Security Strategy, the U.S. must take deliberate steps to ensure the highest quality recruits are selected for enlistment in the branches of

[32] U.S. Department of Defense. Force of the Future official website. 2017. https://www.defense.gov/News/Special-Reports/0315_Force-of-the-Future

the U.S. military and the military must remain poised to guard our enduring national interests. [33]

[33] Barack H. Obama. The White House. *National Security Strategy.* Washington, DC. 2015. https://www.whitehouse.gov/sites/default/files/docs/2015_national_security_strategy.pdf

Chapter 3: Methodology

Introduction

The research in this study is qualitative in nature and is used to gain an understanding of the potential impact that changes in ASVAB scores could have on Army force readiness. This qualitative data helps to gain further insight into potential problems in order to develop ideas and recommendations for further quantitative research.

Research Approach

This study utilizes a social science approach and archival records are examined to analyze the ASVAB scores for Army enlisted applicants from 2003, 2009, and 2015. Changes in mean scores are identified, the significance of those changes are tested through use of unpaired independent samples T-test, and the potential impact those changes may have on force readiness of the U.S. Army is discussed. No personally identifiable information will be used.

Research Question

How have ASVAB scores for General Science, Math Reasoning, Word Knowledge, and Mechanics changed since 2003 as compared to 2009, and, 2015; are these changes statistically significant; and what are the implications for future force readiness of the U.S. Army?

Target Population

The target population is all Army enlisted applicants who took the ASVAB in 2003 (12,768), 2009 (10,651) and 2015 (9,542) for a total population of 32,961 persons. Gender of the test takers is not known.

Research Limitations

The ASVAB is used by all branches of the military services to measure aptitude for military service, however a study across all branches is far too extensive and complex for this study. Although future study of the other branches of the armed services may be beneficial, the scope of this study is limited to all Army enlisted applicants who took the ASVAB in 2003, 2009, and 2015.

Sampling and Technique

The sample group is all Army enlisted applicants who took the ASVAB in 2003, 2009, and 2015. Random sampling was not used in this study. Raw ASVAB score data was requested from the Defense Manpower Data Center for all enlisted applicants from all U.S. military services who had taken the ASVAB from 1989-2015. From this data, only the data for Army applicants for 2003, 2009, and 2015 were isolated and analyzed. More specifically, data relating to General Science, Math Reasoning, Word Knowledge, and Mechanical Comprehension were assessed.

Variables

The dependent variable in this study is the ASVAB score. The independent variable in this study are 2003, 2009, and 2015.

External Validity

Although all branches of the U.S. military use the ASVAB as an assessment of readiness and aptitude for military service, this study seeks to identify changes in ASVAB scores only for Army enlisted applicants to determine how those scores impact Army force readiness. The results of this study should not be projected generally across all branches of the military services without further inquiry. Generalization across other branches of the military services is a threat to external validity.

Statistical Methods of Analysis

Using Graph Pad software, an unpaired independent samples T-Test was performed comparing ASVAB General Science, Math Reasoning, Word Knowledge, and Mechanics mean scores with scores in the same categories: 2003 to 2009, 2009 to 2015, and 2003 to 2015.[1]

Focus of Study

During this study, the ASVAB scores for 2003, 2009, and 2015 were investigated based upon data provided by the U.S. Department of Defense, Defense Manpower Data Center. More specifically the study focused upon the ASVAB scores for the General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), and Mechanical Comprehension (MC) subtests. Once identified, the scores from 2003 were compared with the scores for 2009 to determine if there had been any changes. Scores for 2009 were compared with scores from 2015 to determine if there had been any changes, and scores

[1] Graphpad Software webpage. https://www.graphpad.com/quickcalcs/ttest1.cfm

from 2003 were compared with scores from 2015 to determine if there had been any overall changes. Once changes were identified, an unpaired independent samples T-Test was conducted to determine if the changes were statistically significant. An unpaired independent samples T-test measures whether the difference between sample averages is likely to represent an actual difference between populations, and the effect size indicates whether that difference is large enough to be practically meaningful.[2]

Following the assessment of these factors, the author identified which Subject Area scores might be impacted as a result of changes in Subtest scores. By understanding which Subject Area tests are impacted by a particular Subtest score, the author then identified the potential impact the change may have on future force readiness. Those areas of impact are identified along with recommendations for additional study in the conclusions and recommendations section of this thesis.

[2] http://docs.statwing.com/examples-and-definitions/t-test/

Chapter 4: Summary of Findings

2003 - 2009

When comparing data from 2003 and 2009, there were notable changes in the Armed Services Vocational Aptitude Battery (ASVAB) scores for Army enlisted applicants in the areas of General Science, Math Reasoning, Word Knowledge, and Mechanical Comprehension. A summary of the findings is below.

General Science (GS)

The General Science (GS) portion of the ASVAB consists of twenty-five questions completed in eleven minutes, and measures knowledge of physical and biological sciences. [1] The General Science (GS) subtest score is considered as a factor when calculating Subject Area scores in the following areas;

- Electronics (EL)
- General Maintenance (GM)
- Skilled Technical (GT)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB General Science mean scores from 2003 (M=52.87, SD=7.77) and 2009 (M=52.73, SD= 7.91). Results show that the .14 point mean difference was not statistically significant $t(23419)= 0.103$, $p > .05$, indicating that on average the 2009 General Science scores although lower

[1] Ellen Moreau. Naval Postgraduate School. *Forecasting High-Tech ASVAB Scores.* 1992.

than the General Science scores in 2003, the drop in scores was not statistically significant.

Therefore when considered by itself, this .14% drop in the mean scores for General Science from 2003 to 2009 does not necessarily indicate negative implications for the General Science score, or the Electronics, General Maintenance, and Skilled Technical Subject Area scores, which rely on the General Science subtest score as a factor in their calculation.

Arithmetic Reasoning (AR)

The Arithmetic Reasoning (AR) portion of the ASVAB consists of 30 questions completed in 36 minutes and measures the test-takers ability to solve arithmetic word problems.[2] The Arithmetic Reasoning (AR) subtest score is considered as a factor when calculating Subject Area scores in the following areas;

- Clerical (CL)
- Electronics (EL)
- Field Artillery (FA)
- General Technical (GT)
- Surveillance and Communications (SC)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB arithmetic Reasoning (AR) mean scores from 2003 (M=53.13, SD=7.47) and 2009 (M=53.54, SD=7.01). Results show that the .41 point mean difference was statistically significant $t(23419) = .09$, $p < .05$, indicating that on average the 2009 Arithmetic

[2] Moreau. 1992.

Reasoning (AR) scores were significantly higher than the Arithmetic Reasoning (AR) scores in 2003.

This .41 point increase in the mean scores for Arithmetic Reasoning from 2003 to 2009 could indicate positive implications for not only the Arithmetic Reasoning score, but also for the Clerical, Electronics, Field Artillery, General technical, and Surveillance and Communications Subject Area scores, which rely on the Arithmetic Reasoning subtest score as a factor in their calculation.

Word Knowledge (WK)

The Word Knowledge (WK) portion of the ASVAB consists of 35 questions completed over a period of 11 minutes, and measures the test-taker's ability to select the correct meanings of words presented in context and to identify the best synonym for a given word.[3] The Word Knowledge (WK) subtest score is considered as a factor when calculating Subject Area scores in the following areas;

- Clerical (CL)
- Combat (CO)
- General Technical (GT)
- Operators and Food (OF)
- Surveillance and Communications (SC)
- Skilled Technical (ST)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB Word Knowledge (WK) mean scores from 2003 (M=53.62, SD=5.54) and 2009 (M=52.64,

[3] Ibid.

SD=7.39). Results show that the .98 point mean difference was statistically significant $t(23419) = 11.58$, $p < .05$, indicating that on average the 2009 Word Knowledge (WK) scores were significantly lower than the Word Knowledge (WK) scores in 2003.

This .98 point drop in the mean scores for Word Knowledge from 2003 to 2009 indicates possible negative implications for not only the Word Knowledge score, but also for the Clerical, Combat, General Technical, Operations and Food, Surveillance and Communications, and Skilled Technical Subject Area scores, which rely on the Word Knowledge subtest score as a factor in their calculation.

Mechanical Comprehension (MC)

The Mechanical Comprehension (MC) portion of the ASVAB consists of 25 questions completed over a period of 19 minutes, and measures the test-taker's knowledge of mechanical and physical principles and his/her ability to visualize how illustrated objects work. [4] Mechanical Comprehension (MC) subtest score is considered as a factor when calculating Subject Area scores in the following areas;

- Combat (CO)
- Field Artillery (FA)
- Mechanical Maintenance (MM)
- Operators and Food (OF)
- Surveillance and Communications (SC)
- Skilled Technical (ST)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB Mechanical Comprehension (MC) mean scores from 2003 (M=46.74, SD=18.62) and

[4] Ibid.

2009 (M=52.29, SD=13.84). Results show that the 5.55 point mean difference was statistically significant $t(23419) = 25.45$, $p < .05$, indicating that on average the 2009 Mechanical Comprehension (MC) scores were significantly higher than the Mechanical Comprehension (MC) scores in 2003.

This 5.55 point increase in the mean scores for Mechanical Comprehension from 2003 to 2009 indicates possible positive implications for not only the Mechanical Comprehension score, but also for the Combat, Field Artillery, Mechanical Maintenance, Operations and Food, Surveillance and Communications, and Skilled Technical subject area scores, which rely on the Mechanical Comprehension subtest score as a factor in their calculation.

2009 - 2015

When comparing scores from 2009 and 2015, there were statistically significant fluctuations in the Armed Services Vocational Aptitude Battery (ASVAB) scores for Army enlisted applicants in the areas of General Science, Math Reasoning, Word Knowledge, and Mechanical Comprehension. A summary of the findings is below.

General Science (GS)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB General Science mean scores from 2009 (M=52.73, SD=7.91) and 2015 (M=51.94, SD=8.07). Results show that the .79 point mean difference was statistically significant $t(20191) = 7.01$, $p < .05$, indicating that on average the 2015 General Science scores were significantly lower than the General Science scores in 2009.

This .79 point drop in the mean scores for General Science from 2009 to 2015 indicates possible negative implications for not only the General Science score, but also for the Electronics, General Maintenance, and Skilled Technical Subject Area scores, which rely on the General Science subtest score as a factor in their calculation. This decline in General Science scores could indicate a potential decline in scores in these other areas as stated.

Arithmetic Reasoning (AR)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB arithmetic Reasoning (AR) mean scores from 2009 ($M=53.54$, $SD=7.01$) and 2015 ($M=52.97$, $SD=7.12$). Results show that the .57 point mean difference was statistically significant $t(20191) = 5.72$, $p < .05$, indicating that on average the 2015 Arithmetic Reasoning (AR) scores were significantly lower than the Arithmetic Reasoning (AR) scores in 2009.

This .57 point drop in the mean scores for Arithmetic Reasoning from 2009 to 2015 indicates possible negative implications for not only the Arithmetic Reasoning score, but also for the Clerical, Electronics, Field Artillery, General technical, and Surveillance and Communications Subject Area scores, which rely on the Arithmetic Reasoning subtest score as a factor in their calculation. This decline in Arithmetic Reasoning scores could indicate a potential decline in scores in these other areas as stated.

Word Knowledge (WK)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB Word Knowledge (WK) mean scores from 2009 (M=52.64, SD=7.39) and 2015 (M=51.46, SD=7.13). Results show that the 1.18 point mean difference was statistically significant $t(20191) = 11.51$, $p < .05$, indicating that on average the 2015 Word Knowledge (WK) scores were significantly lower than the Word Knowledge (WK) scores in 2009.

This 1.18 point drop in the mean scores for Word Knowledge from 2009 to 2015 indicates possible negative implications for not only Word Knowledge score, but also for the Clerical, Combat, General Technical, Operations and Food, Surveillance and Communications, and Skilled Technical Subject Area scores, which rely on the Word Knowledge subtest score as a factor in their calculation. This decline in Word Knowledge scores could indicate a potential decline in scores in these other areas as stated.

Mechanical Comprehension (MC)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB Mechanical Comprehension (MC) mean scores from 2009 (M=52.29, SD=13.84) and 2015 (M=48.58, SD=18.96). Results show that the 3.71 point mean difference was statistically significant $t(20191) = 15.99$, $p < .05$, indicating that on average the 2015 Mechanical Comprehension (MC) scores were significantly lower than the Mechanical Comprehension (MC) scores in 2009.

This 3.71 point decrease in the mean scores for Mechanical Comprehension from 2009 to 2015 indicates possible negative implications for not only the Mechanical Comprehension score, but also for the Combat, Field Artillery, Mechanical Maintenance,

Operations and Food, Surveillance and Communications, and Skilled Technical subject area scores, which rely on the Mechanical Comprehension subtest score as a factor in their calculation. This decrease in Mechanical Comprehension scores could indicate a potential decrease in scores in these other areas as stated.

2003 - 2015

Between 2003 and 2015, there were statistically significant fluctuations in the Armed Services Vocational Aptitude Battery (ASVAB) scores for Army enlisted applicants in the areas of General Science, Math Reasoning, Word Knowledge, and Mechanics. A summary of the findings is below.

General Science (GS)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB General Science mean scores from 2003 (M=52.87, SD=7.77) and 2015 (M=51.94, SD= 8.07). Results show that the .93 point mean difference was statistically significant $t(22308) = 8.69$, $p < .05$, indicating that on average the 2015 General Science scores were significantly lower than the General Science scores in 2003.

Data analysis:

This .93 point drop in the mean scores for General Science from 2003 to 2015 indicates possible negative implications for not only the General Science score, but also for the Electronics, General Maintenance, and Skilled Technical Subject Area scores, which rely on the General Science subtest score as a factor in their calculation. This

decline in General Science scores could indicate a potential decline in scores in these other areas as stated.

Arithmetic Reasoning (AR)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB arithmetic Reasoning (AR) mean scores from 2003 (M=53.13, SD=7.47) and 2015 (M=52.97, SD= 7.12). Results show that the .16 point mean difference was not statistically significant $t(22308) = 1.61$, $p > .05$, indicating that on average although the 2015 Arithmetic Reasoning (AR) scores were slightly lower than the Arithmetic Reasoning (AR) scores in 2003, the difference was not of statistical significance.

This .16 point drop in the mean scores for Arithmetic Reasoning from 2003 to 2015 points to neither negative nor positive implications for the Arithmetic Reasoning score, but also for the Clerical, Electronics, Field Artillery, General technical, and Surveillance and Communications Subject Area scores, which rely on the Arithmetic Reasoning subtest score as a factor in their calculation.

Word Knowledge (WK)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB Word Knowledge (WK) mean scores from 2003 (M=53.62, SD=5.54) and 2015 (M=51.46, SD= 7.13). Results show that the 2.16 point mean difference was statistically significant $t(22308) = 27.81$, $p < .05$, indicating that on average the 2015 Word

Knowledge (WK) scores were significantly lower than the Word Knowledge (WK) scores in 2003.

This 2.16 point drop in the mean scores for Word Knowledge from 2003 to 2015 indicates possible negative implications for not only Word Knowledge score, but also for the Clerical, Combat, General Technical, Operations and Food, Surveillance and Communications, and Skilled Technical Subject Area scores, which rely on the Word Knowledge subtest score as a factor in their calculation. This decline in Word Knowledge scores could indicate a potential decline in scores in these other areas as stated.

Mechanical Comprehension (MC)

Data analysis:

An unpaired independent samples T-Test was performed comparing ASVAB Mechanical Comprehension (MC) mean scores from 2003 (M=46.74, SD=18.62) and 2015 (M=48.58, SD= 18.96). Results show that the 1.84 point mean difference was statistically significant $t(22308) = 7.24$, $p < .05$, indicating that on average the 2015 Mechanical Comprehension (MC) scores were significantly higher than the Mechanical Comprehension (MC) scores in 2003.

This 1.84 point increase in the mean scores for Mechanical Comprehension from 2003 to 2015 indicates possible positive implications for not only the Mechanical Comprehension score, but also for the Combat, Field Artillery, Mechanical Maintenance, Operations and Food, Surveillance and Communications, and Skilled Technical subject area scores, which rely on the Mechanical Comprehension subtest score as a factor in their

calculation. This increase in Mechanical Comprehension scores could indicate a potential increase in scores in these other areas as stated.

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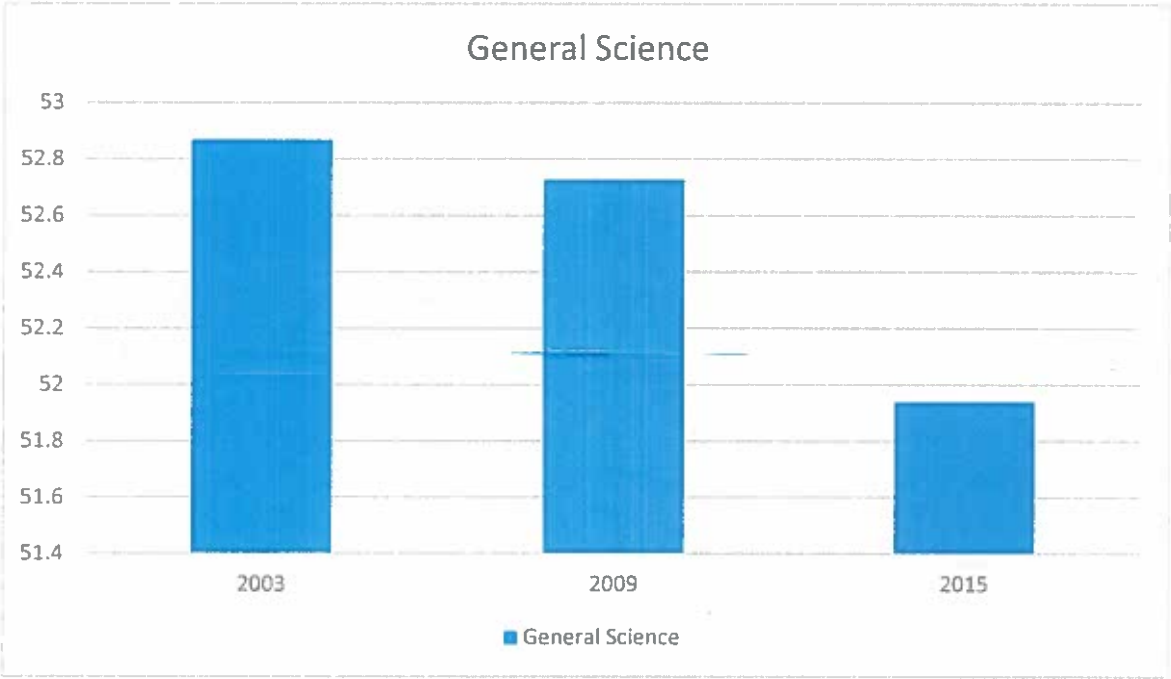
Chapter 5: Summary

Analysis Results

In summary, when comparing the ASVAB mean scores from 2003 to the scores for 2015 in the areas of General Science (GS), Arithmetic Reasoning (AR), Word Knowledge (WK), and Mechanical Comprehension (MC), there were notable changes in the mean scores of each subtest area. After performing unpaired independent samples T-Test for all subject area scores, it was determined that some changes were statistically significant while others were not. What follows is a summary of the analysis and a brief discussion of each.

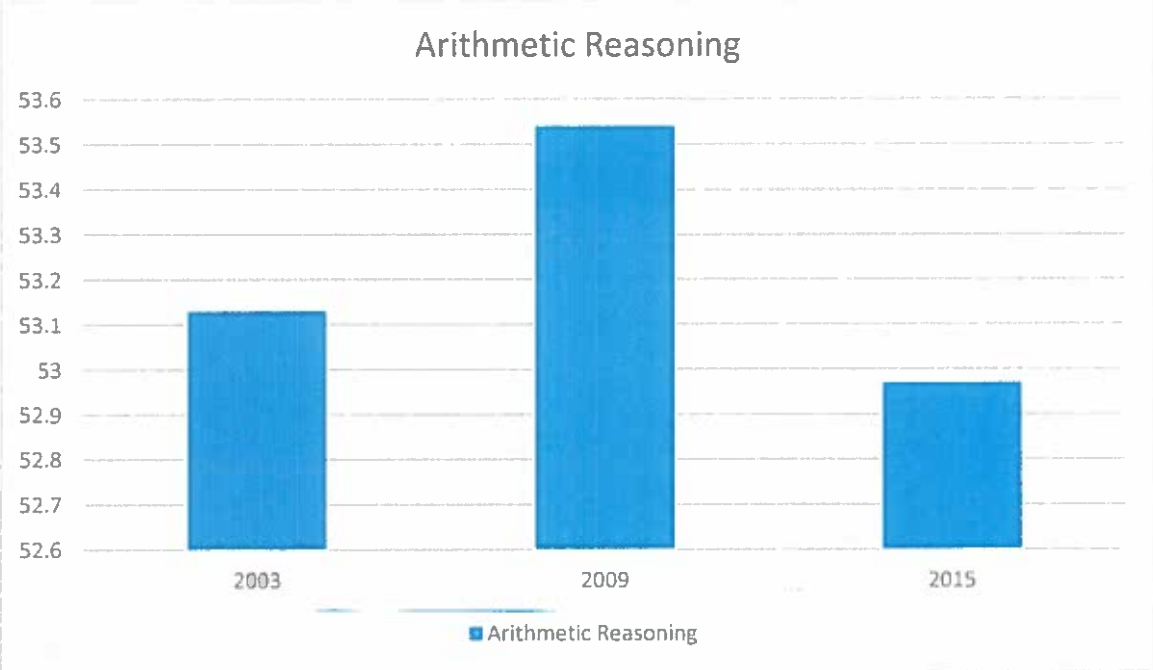
Data Analysis

General Science (GS)



The data shows a general decline in test scores for the General Science (GS) component of the ASVAB from 2003 to 2015. Although a modest decline of .14 points in the mean scores from 2003 to 2009 was not considered statistically significant, the further decline of .79 points between 2009 and 2015 was statistically significant. When considering an overall drop of .93 points in the mean score for the General Science (GS) test between 2003 and 2015, this overall decrease in scores indicates negative implications for not only the General Science (GS) score, but also for the Electronics, General Maintenance, and Skilled Technical Subject Area scores, which rely on the General Science (GS) subtest score as a factor in their calculation.

Arithmetic Reasoning (AR)

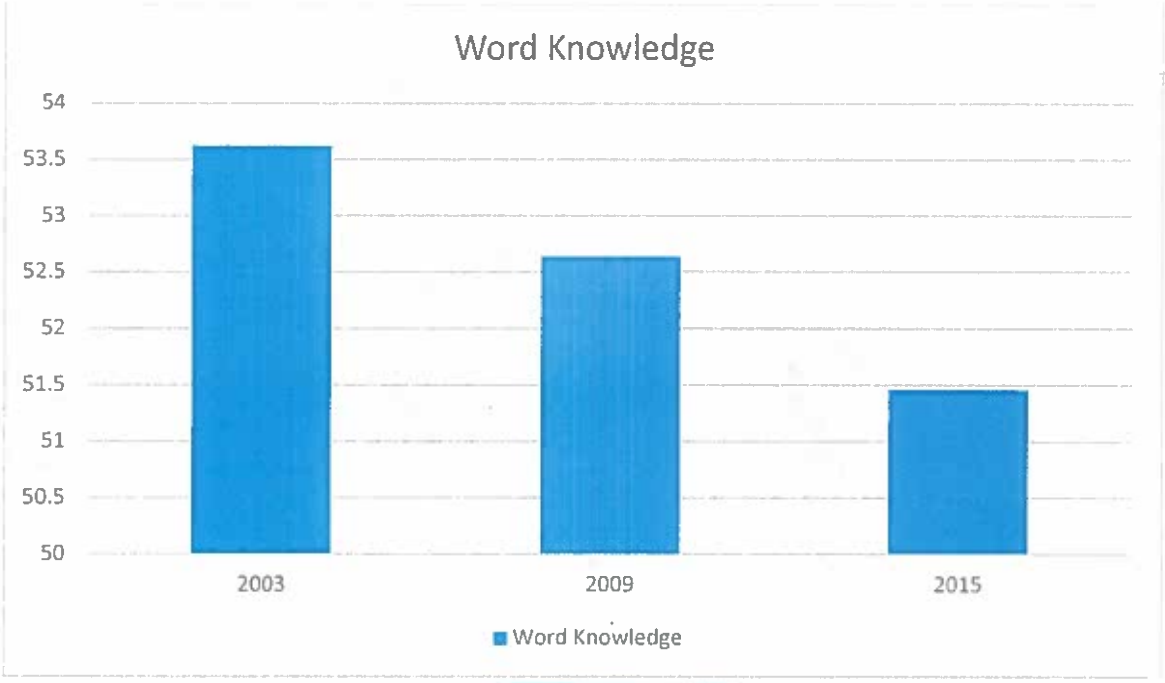


Arithmetic Reasoning (AR)

The data shows that there was not a statistically significant change in mean score for the Arithmetic Reasoning (AR) subtest from 2003 to 2015. While a statistically

significant increase of .41 points was observed between 2003 and 2009, it was followed by a statistically significant decline of .57 points between 2009 and 2015. Despite the peak in the 2009 mean test scores, when comparing the 2003 mean score of 53.13 to the 2015 mean score of 52.97, the small overall decline of .16 points in the mean score from 2003 to 2015 is not statistically significant. Likewise, this change in scores from 2003 to 2015 should have little overall positive or negative implications for the Clerical, Electronics, Field Artillery, General Technical, and Surveillance and Communications Subject Area scores, which rely on the Arithmetic Reasoning subtest score as a factor in their calculation.

Word Knowledge (WK)

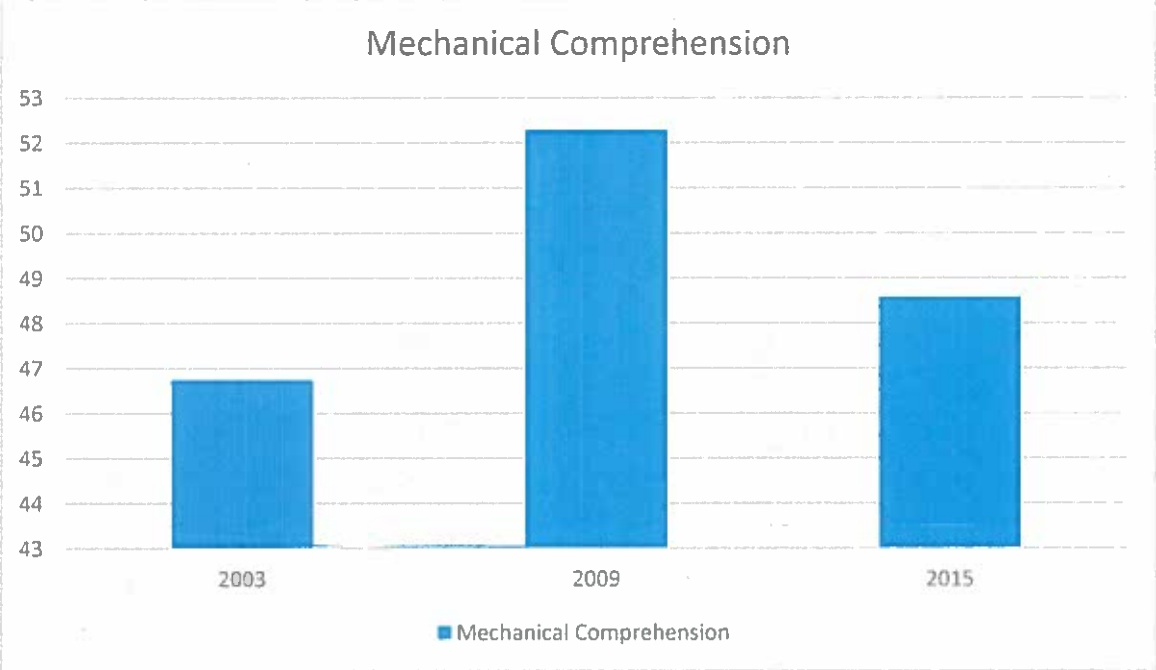


Word Knowledge (WK)

The data shows a general decline in test scores for the Word Knowledge (WK) component of the ASVAB from 2003 to 2015. A decline of .98 points in the mean scores

from 2003 to 2009 was considered statistically significant and the further decline of 1.18 points between 2009 and 2015 was statistically significant. When considering an overall drop of 2.16 points in the mean score for the Word Knowledge (WK) test between 2003 and 2015, this overall decrease in scores indicates negative implications for not only the Word Knowledge (WK) score, but also for the Clerical, Combat, General Technical, Operators and Food, Surveillance and Communications, and Skilled Technical Subject Area (SA) scores which rely on the Word Knowledge (WK) subtest score as a factor in their calculation.

Mechanical Comprehension (MC)



Mechanical Comprehension (MC)

The data shows a general increase in test scores for the Mechanical Comprehension (MC) component of the ASVAB from 2003 to 2015. An increase of 5.55 points in the mean scores from 2003 to 2009 was considered statistically significant and a subsequent

decrease of 3.71 points in the mean score between 2009 and 2015 was also statistically significant. When considering the an overall increase of 1.84 points in the mean score for the Mechanical Comprehension (MC) test between 2003 and 2015, this could indicate positive implications for not only the Mechanical Comprehension (MC) score, but also for the Combat, Field Artillery, Mechanical Maintenance, Operations and Food, Surveillance and Communications, and Skilled Technical subjects areas scores which rely on the Mechanical Comprehension (MC) subtest score as a factor in their calculation.

The key takeaways from this chapter are that the study revealed a statistically significant decline in ASVAB mean scores in areas of General Science, and Word Knowledge. These declines have potentially negative implications for the Electronics, General Maintenance, Skilled Technical, Clerical, Combat, General Technical, Operators and Food, Surveillance and Communications subject area scores. The Arithmetic Reasoning subtest score showed no improvement during the period studied which impacts subject area scores for Clerical, Electronics, Field Artillery, General Technical, and Surveillance and Communications. Actual gains were observed in the Mechanical Comprehension subtest scores, which saw a statistically significant increase between 2003 and 2015. These gains have a direct impact on the Combat, Field Artillery, Mechanical Maintenance, Operations and Food, Surveillance and Communications, and Skilled Technical subject area scores, although the extent of the impact on those scores is not addressed here and should be the subject of future inquiry.

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Chapter 6: Conclusions and Recommendations

As part of America's joint fighting force, the Army must maintain its force readiness at all times to ensure the national security of the United States and sustain its ability to project power around the globe. The increasing technological demands require the recruitment of soldiers who have the ability and aptitude to serve in increasingly complex and high-tech domains across the span of a normal military career. The Army's readiness is its ability to defeat, deny, or deter hybrid, near-peer threats and meet operational domain requirements. This readiness is directly impacted by the Army's ability to recruit and retain a skilled fighting force capable of taking on the rigorous demands of today and into the foreseeable future.

This study revealed a statistically significant decline in ASVAB mean scores in areas of General Science, and Word Knowledge. These declines have potentially negative implications for the Electronics, General Maintenance, Skilled Technical, Clerical, Combat, General Technical, Operators and Food, Surveillance and Communications subject area scores. The Arithmetic Reasoning subtest score showed no improvement during the period studied which impacts subject area scores for Clerical, Electronics, Field Artillery, General Technical, and Surveillance and Communications. Actual gains were observed in the Mechanical Comprehension subtest scores, which saw a statistically significant increase between 2003 and 2015. These gains have a direct impact on the Combat, Field Artillery, Mechanical Maintenance, Operations and Food, Surveillance and Communications, and Skilled Technical subject area scores, although the extent of the impact on those scores is not addressed here and should be the subject of future inquiry.

Two conclusions can be drawn from this study. First, the statistically significant declines in General Science, and Word Knowledge ASVAB scores between 2003 and 2015 do have an impact on Army Force Readiness. The drop in scores means that Army enlisted applicants who took the ASVAB in 2015 had less aptitude in the specified areas than similar recruits in 2003. This drop in scores impacts the area of test scores that rely on the subtests as a factor in their calculation. As a result of the lower subtest and subject area test scores, a smaller pool of qualified candidates exists from which to choose recruits. This could mean a negative impact on Army force readiness.

The second conclusion to be drawn from this study is that the rise in scores in the area of Mechanical Comprehension means that the Army recruits who took the ASVAB in 2015 had a higher aptitude in this area than similar recruits in 2003. This means a larger pool of candidates from which to recruit enlisted applicants, which means a better qualified candidate pool from which to select Army enlisted applicants. This means a positive impact on force readiness due to a larger group from which to select enlisted personnel.

Recommendations:

Two recommendations come as a result of the research in this study.

1. Further research to investigate whether the negative impact on force readiness caused by the lower mean test scores requires corrective action.
2. Additional study into the remaining ASVAB Subtest areas which were not studied in this case, to provide a clearer picture.

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Appendix

Sample ASVAB Questions[5]

GENERAL SCIENCE

Q1. A magnet will attract

- A. water.
- B. a flower.
- C. a cloth rag.
- D. a nail.

Q2. An eclipse of the sun throws the shadow of the

- A. moon on the sun.
- B. moon on the earth.
- C. earth on the sun.
- D. earth on the moon.

Q3. Air is less dense than water because

- A. it is lighter.
- B. its molecules are further apart.
- C. its molecules are closer together.
- D. it moves more quickly.

Q4. Salt helps to melt ice because it

- A. dissolves in water to form an acid.

[5] U.S. Army ASVAB Program. http://www.asvabprogram.com/parents-test

- B. chemically destroys the water molecules.
- C. lowers the temperature at which water freezes.
- D. is attracted to concrete sidewalks below the ice.

Q5. Substances that hasten chemical reaction time without themselves undergoing change are called

- A. buffers.
- B. colloids.
- C. reducers.
- D. catalysts.

ARITHMETIC REASONING

Q6. If 12 workers are needed to run 4 machines, how many workers are needed to run 20 machines?

- A. 20
- B. 48
- C. 60
- D. 80

Q7. How many 36-passenger buses will it take to carry 144 people?

- A. 3
- B. 4
- C. 5
- D. 6

Q8. If the tire of a car rotates at a constant speed of 552 times in one minute, how many times will the tire rotate in half-an-hour?

- A. 276
- B. 5,520
- C. 8,280
- D. 16,560

Q9. A motorcycle costs $7,250. If it depreciates by 12% per year, how much will it be worth after one year?

- A. $870
- B. $1,250
- C. $5,920
- D. $6,380

Q10. It costs $0.50 per square yard to waterproof canvas. What will it cost to waterproof a canvas truck cover that is 15' x 24' ?

- A. $6.67
- B. $18.00
- C. $20.00
- D. $180.00

MATHEMATICS KNOWLEDGE

Q11. If 50 percent of X = 66, then X =

- A. 33
- B. 66
- C. 99
- D. 132

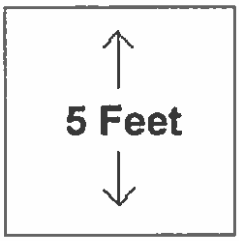
Q12. The answer to this equation is:

- $\sqrt{\frac{27}{3}}$
- A. $\sqrt{3}$
- B. 3
- C. 9
- D. 12

Q13. If X + 6 = 7, then X is equal to

- A. -1
- B. 0
- C. 1
- D. 7/6

Q14. What is the area of this square?



- A. 1 square foot
- B. 5 square feet
- C. 10 square feet
- D. 25 square feet

Q15. The answer to this equation is:

- If $x - y \neq 0$, then $\frac{x^2 - y^2}{x - y}$ =
- A. x + y

- B. x - y
- C. x + 2y
- D. 2x - y

WORD KNOWLEDGE

Q16. Small most nearly means

- A. sturdy.
- B. round.
- C. cheap.
- D. little.

Q17. The wind is variable today.

- A. mild.
- B. steady.
- C. shifting.
- D. chilling

Q18. Rudiments most nearly means

- A. politics.
- B. minute details.
- C. promotion opportunities.
- D. basic methods and procedures.

Q19. Antagonize most nearly means

- A. embarrass.
- B. struggle.

- C. provoke.
- D. worship.

Q20. His record provides no reason for apprehension.

- A. anxiety.
- B. change.
- C. enjoyment.
- D. endorsement.

PARAGRAPH COMPREHENSION

Q21. From a building designer's standpoint, three things that make a home livable are the client, the building site, and the amount of money the client has to spend. According to this statement, to make a home livable,

- A. the prospective piece of land makes little difference.
- B. it can be built on any piece of land.
- C. the design must fit the owner's income and site.
- D. the design must fit the designer's income.

Q22. Twenty-five percent of all household burglaries can be attributed to unlocked windows or doors. Crime is the result of opportunity plus desire. To prevent crime, it is each individual's responsibility to

- A. provide the desire.
- B. provide the opportunity.
- C. prevent the desire.
- D. prevent the opportunity.

Q23. In certain areas, water is so scarce that every attempt is made to conserve it. For instance, on one oasis in the Sahara Desert the amount of water necessary for each date palm tree has been carefully determined. How much water should each tree be given?

- A. no water at all.
- B. exactly the amount required.
- C. water on alternate days.
- D. water only if it is healthy.

Q24. A thin transparent layer of oxide protects the metal titanium against corrosion. The same thin layer attracts artists interested in making their art with the help of technology. By using heat or electricity, an artist can thicken the oxide layer and thereby turn the metal a range of vivid colors. According to the passage, some artists work with titanium because it

- A. is transparent.
- B. does not corrode.
- C. generates its own heat.
- D. can assume a variety of colors.

Q25. They returned to the beach, where blankets spotted the slope to the water. An advancing wall of clouds, black and gray, darkening the expanse of ground beneath, approached from the west. To the east and above them, the sky remained clear, the sun warm, as if collaborating in the deception. The "deception" referred to in the passage is that

- A. there is no storm approaching.
- B. the sky is clear in the east.
- C. it is too cold to swim.
- D. the sun is warm.

ELECTRONICS INFORMATION

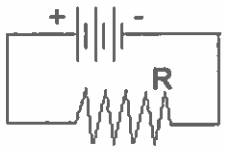
Q26. What does the abbreviation AC stand for?

- A. additional charge
- B. alternating coil
- C. alternating current
- D. ampere current

Q27. Which of the following has the least resistance?

- A. wood
- B. iron
- C. rubber
- D. silver

Q28. In this circuit diagram, the resistance is 100 ohms, and the current is 0.1 amperes. The voltage is

- 

- A. 5 volts.
- B. 10 volts.
- C. 100 volts.
- D. 1,000 volts.

Q29. Which of the following is measured using a ohmmeter?

- A. voltage
- B. resistance
- C. inductance
- D. capacitance

Q30. Because solid state diodes have no filament, they

- A. don't work.
- B. are less efficient than tubes.
- C. require less operating power.

- D. require more operating power.

AUTO AND SHOP INFORMATION

Q31. A chisel is used for

- A. prying.
- B. cutting.
- C. twisting.
- D. grinding.

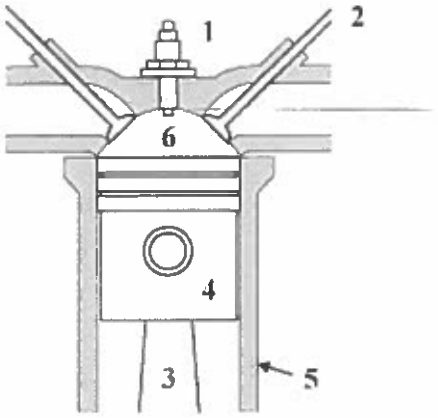
Q32. A car uses too much oil when which of the following parts are worn?

- A. pistons
- B. piston rings
- C. main bearings
- D. connecting rods

Q33. The saw shown is used mainly to cut

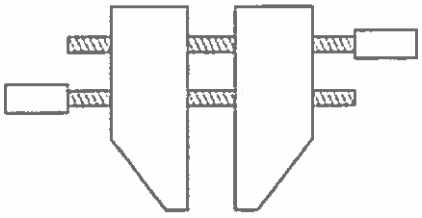
- A. plywood.
- B. odd-shaped holes in wood.
- C. along the grain of the wood.
- D. across the grain of the wood.

Q34. Where does combustion take place?



- A. 3
- B. 4
- C. 5
- D. 6

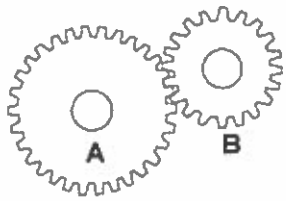
Q35. The clamp shown is called a



- A. bar clamp
- B. web clamp
- C. spring clamp
- D. parallel clamp

MECHANICAL COMPREHENSION

Q36. If gear A makes 14 revolutions, gear B will make

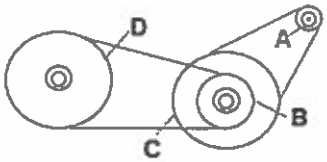


- A. 21
- B. 17
- C. 14
- D. 9

Q37. Which post holds up the greater part of the load?/p>

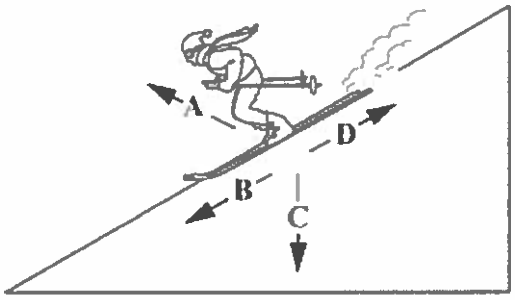
- A. post A
- B. post B
- C. both equal
- D. not clear

Q38. In this arrangement of pulleys, which pulley turns fastest?



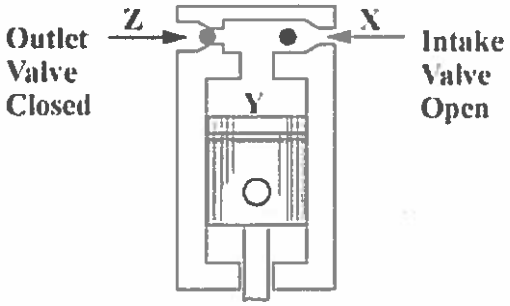
- A. A
- B. B
- C. C
- D. D

Q39. In which direction does friction act on this skier?



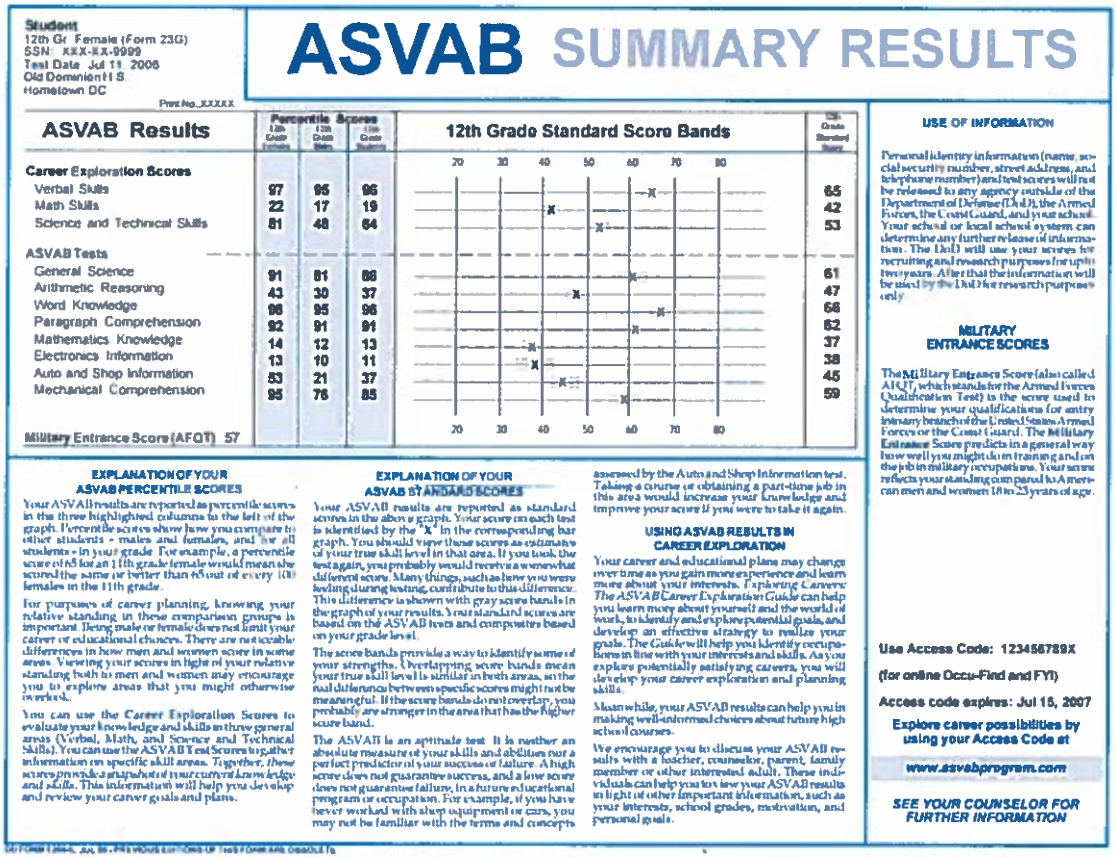
- A. A
- B. B
- C. C
- D. D

Q40. Why does the intake valve open on this pump when the piston goes down?



- A. Air pressure at X is less than air pressure at Y.
- B. Air pressure at Z is less than air pressure at X.
- C. Air pressure at X is greater than air pressure at Y.
- D. Air pressure at Y is greater than air pressure at Z.

Sample ASVAB Score Results



Student
12th Gr Female (Form 23G)
SSN: XXX-XX-9999
Test Date Jul 11 2006
Old Dominion H S
Hometown DC
Print No. XXXXX

ASVAB SUMMARY RESULTS

ASVAB Results	Percentile Scores 12th Grade Ref.	12th Grade Men	12th Grade Women	12th Grade Standard Score Bands	12th Grade Standard Score
Career Exploration Scores					
Verbal Skills	97	96	96		65
Math Skills	22	17	19		42
Science and Technical Skills	81	48	64		53
ASVAB Tests					
General Science	91	81	88		61
Arithmetic Reasoning	43	30	37		47
Word Knowledge	98	95	96		66
Paragraph Comprehension	92	91	91		62
Mathematics Knowledge	14	12	13		37
Electronics Information	13	10	11		38
Auto and Shop Information	53	21	37		45
Mechanical Comprehension	95	76	85		59
Military Entrance Score (AFQT) 57					

12th Grade Standard Score Bands: 20 30 40 50 60 70 80

EXPLANATION OF YOUR ASVAB PERCENTILE SCORES

Your ASVAB results are reported as percentile scores in the three highlighted columns to the left of the graph. Percentile scores show how you compare to other students - males and females, and for all students - in your grade. For example, a percentile score of 85 for an 11th grade female would mean she scored the same or better than 85 out of every 100 females in the 11th grade.

For purposes of career planning, knowing your relative standing in these comparison groups is important. Being male or female does not limit your career or educational choices. There are not sizable differences in how men and women score in some areas. Viewing your scores in light of your relative standing both to men and women may encourage you to explore areas that you might otherwise overlook.

You can use the Career Exploration Scores to evaluate your knowledge and skills in three general areas (Verbal, Math, and Science and Technical Skills). You can use the ASVAB Test Scores to gather information on specific skill areas. Together, these scores provide a snapshot of your current knowledge and skills. This information will help you develop and review your career goals and plans.

EXPLANATION OF YOUR ASVAB STANDARD SCORES

Your ASVAB results are reported as standard scores in the above graph. Your score on each test is identified by the "X" in the corresponding bar graph. You should view these scores as estimates of your true skill level in that area. If you took the test again, you probably would receive a somewhat different score. Many things, such as how you were feeling during testing, contribute to this difference. This difference is shown with gray score bands in the graph of your results. Your standard scores are based on the ASVAB tests and composites based on your grade level.

The score bands provide a way to identify some of your strengths. Overlapping score bands mean your true skill level is similar in both areas, so the real difference between specific scores might not be meaningful. If the score bands do not overlap, you probably are stronger in the area that has the higher score band.

The ASVAB is an aptitude test. It is neither an absolute measure of your skills and abilities nor a perfect predictor of your success or failure. A high score does not guarantee success, and a low score does not guarantee failure, in a future educational program or occupation. For example, if you have never worked with shop equipment or cars, you may not be familiar with the terms and concepts assessed by the Auto and Shop Information test. Taking a course or obtaining a part-time job in this area would increase your knowledge and improve your score if you were to take it again.

USING ASVAB RESULTS IN CAREER EXPLORATION

Your career and educational plans may change over time as you gain more experience and learn more about your interests. *Exploring Careers: The ASVAB Career Exploration Guide* can help you learn more about yourself and the world of work, to identify and explore potential goals, and develop an effective strategy to realize your goals. The *Guide* will help you identify occupations in line with your interests and skills. As you explore potentially satisfying careers, you will develop your career exploration and planning skills.

Meanwhile, your ASVAB results can help you in making well-informed choices about future high school courses.

We encourage you to discuss your ASVAB results with a teacher, counselor, parent, family member or other interested adult. These individuals can help you to view your ASVAB results in light of other important information, such as your interests, school grades, motivation, and personal goals.

USE OF INFORMATION

Personal identity information (name, social security number, street address, and telephone number) and test scores will not be released to any agency outside of the Department of Defense (DoD), the Armed Forces, the Coast Guard, and your school. Your school or local school system can determine any further release of information. The DoD will use your scores for recruiting and research purposes for up to two years. After that the information will be used by the DoD for research purposes only.

MILITARY ENTRANCE SCORES

The Military Entrance Score (also called AFQT, which stands for the Armed Forces Qualification Test) is the score used to determine your qualifications for entry into any branch of the United States Armed Forces or the Coast Guard. The Military Entrance Score predicts in a general way how well you might do in training and on the job in military occupations. Your score reflects your standing compared to American men and women 18 to 23 years of age.

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Institutional Review Board Approval

Joint Forces Staff College
Southern Campus of the National Defense University
7800 Hampton Boulevard, Norfolk, VA 23511

December 22, 2016

Mr. Mark Hoover
Joint Forces Staff College
7800 Hampton Boulevard
Norfolk, Virginia 23511

Dear Mr Hoover:

This letter is to inform you that your IRB application for the project entitled "THE UPS AND DOWNS OF ASVAB: FLUCTUATION OF ARMED SERVICES VOCATIONAL APTITUDE BATTERY SCORES AND IMPLICATIONS FOR FORCE READINESS OF THE U.S. ARMY," has been reviewed and received IRB approval. You may now commence your research and data collection activities.

As you conduct your research study, IRB requires that you continue to follow the procedures you have outlined in your application. If you need to make significant changes to your research project, please notify your advisor and Dr. Elizabeth Carhart in the Institutional Research, Assessment, and Accreditation Division (IRAAD) at JFSC at e.h.carhart.civ@ndu.edu or 443-6195. If you have any questions, please let me know. Good luck with your work!

Sincerely,

Elizabeth Hoag Carhart, Ph.D.
Academic Specialist, IRAAD

VITA

Mark C. Hoover is an employee of the U.S. Department of State and is a Career Member of the Foreign Service of the United States. His duties have taken him to South America, the Middle-East, Pakistan, Russia, the United Kingdom, Switzerland, and elsewhere around the globe. Mark holds degrees in the social sciences, business, and education, is the recipient of various U.S. Department of State awards and honors, and has been recognized by the United States Attorney's Office for his work in combatting terrorist financing.